STANDARD PROJECT OPERATIONAL PLAN
BOTTOM TRAWL SURVEY OF CRAB AND GROUNDFISH:
KODIAK, CHIGNIK, SOUTH ALASKA PENINSULA, AND EASTERN ALEUTIAN AREAS

by

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Regional Information Report[1] No. 4K04-47

Alaska Department of Fish and Game
Division of Commercial Fisheries
211 Mission Road
Kodiak, Alaska, 99615

November 2004

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ABSTRACT

This report specifies the methods and procedures for conducting a trawl survey of the Kodiak, Chignik, South Alaska Peninsula, and Eastern Aleutian Islands areas of the Westward Region. The survey utilizes a 400-mesh eastern otter trawl to sample stations within these areas. Survey results are used to assess the condition and abundance of Tanner crab *Chionoecetes bairdi* and red king crab *Paralithodes camtschaticus* populations, document the prevalence of bitter crab syndrome in Tanner crab from Alitak Bay, and determine species composition and length frequencies of the groundfish catch by haul and area. In addition, Pacific cod *Gadus macrocephalus* will be tagged and released throughout the survey. A special projects operational plan is published annually to describe methods and procedures for short-term or new projects, as well as any changes from the protocols established here.

KEY WORDS: crab, groundfish, *Paralithodes camtschaticus*, *Chionoecetes bairdi*, trawl survey, Kodiak, Alaska Peninsula, Chignik, Eastern Aleutians, bitter crab syndrome, *Gadus macrocephalus*.

INTRODUCTION

The Alaska Department of Fish and Game (ADF&G) has conducted pot surveys for crab stock assessment in the Westward Region since 1963. Early surveys targeted Long Island Bank (Reynolds and Powell 1964), Marmot Flats (McMullen 1967a), Portlock Bank (McMullen 1967b), Albatross Banks (McMullen 1968), and Alitak and Kaguyak Bays (Kingsbury and James 1971) of the Kodiak Area as well as Chignik and Pavlof Bays on the Alaska Peninsula (Colgate and Hicks 1983: Colgate 1984). The last ADF&G pot survey in the Kodiak, Chignik, South Peninsula, and Eastern Aleutian Districts was conducted in 1987.

Trawl-based surveys have replaced pots as the preferred method for crab stock assessment, allowing for quicker coverage of the survey area and capture and sampling of crabs of a wider size range (Jackson 1990). The surveys focus on inshore waters around Kodiak Island and the Alaska Peninsula from Cape Douglas to False Pass, as well as the eastern Aleutian Islands (Figure 1). Trawl surveys in the eastern Aleutian Islands began in 1990 and have generally continued on a triennial basis. In recent years, the trawl survey has become increasingly important for groundfish assessment. Walleye pollock results are directly utilized in the National Marine Fisheries Service (NMFS) population model for determining allowable biological catch.

This report details the sampling procedures in use during the Westward Region trawl surveys, beginning in 2004. Any changes to these procedures, or special projects incorporated into the survey for a particular year will be described in the annual special projects operational plan (Spalinger 2004). Yearly survey schedules and station maps are also included in this annual document.

OBJECTIVES

The shellfish objectives for the trawl survey are to estimate the abundance, size frequency, shell condition, fecundity, and proportion by sex of Tanner crabs *Chionoecetes bairdi*, red king crabs *Paralithodes camtschaticus*, and Dungeness crabs *Cancer magister* and to document the prevalence of bitter crab syndrome (BCS) affecting Tanner crabs in Alitak Bay. Tanner crab chela height morphometric measurements will be taken in the Marmot Bay area and shell height of weathervane scallops *Patinopecten caurinus* will be taken throughout the survey.

The groundfish objectives for the survey are to determine species composition of the catch by haul and area, to obtain length frequency distributions for commercially important groundfish by area, and to tag Pacific cod *Gadus macrocephalus*. In addition, rock sole are differentiated into northern *Lepidopsetta polyxystra* and southern *L. bilineata* species, dusky rockfish are differentiated into light *Sebastes variabilis* and dark *Sebastes melanops* species, sharks are measured to fork length, and skates are speciated. Survey data collection includes adult walleye pollock *Theragra chalcogramma* otoliths for NMFS.

Deployment of a Quester Tangent Corporation (QTC^{TM}) view seabed classification system will be used for mapping bottom habitat types (QTC 1998). Marine mammal observations will be opportunistically recorded during the survey. This will include detailed physical descriptions and interactions observed with fishing gear, the vessel, or other marine mammals.

METHODS

Trawl Description and Station Areas

The 27.4 m ADF&G research vessel *Resolution* will conduct surveys in areas of known king and Tanner crab habitat throughout the Kodiak, Chignik, South Peninsula, and Eastern Aleutian Districts of the Westward Region.

A 400-mesh eastern otter trawl net is designed to sweep a 12.2 m path (Figure 2). The net is constructed with 10.2 cm stretch mesh at the mouth, 8.9 cm stretch mesh in the body, and the codend is lined with 3.2 cm stretch mesh. It has a 21.3 m long headrope with 18 floats that are 20.3 cm in diameter. The footrope is 29.0 m in length and lacks roller gear or a tickler chain. The footrope is weighted with a 1 cm diameter chain attached every 25.4 cm to ensure that the footrope tends bottom (Figure 3). The two dandylines are 45.7 m long; each consists of an 18.3 m section of 1.5 cm cable and a pair of 27.4 m sections of 1.3 cm cable, one attached to the top and the other to the bottom of each net wing. The Astoria "V" type doors, weigh 340 kg each and measure 1.5 m x 2.1 m.

Survey areas are divided into offshore stations of approximately 92 km^2, while inshore stations are approximately 27 km^2. Considerable size variation occurs in most inshore and some offshore stations due to coastline geography. Inshore station areas are calculated seaward from the 20-fathom depth contour. At each station, the trawl is towed on the bottom at a speed of approximately 4.4 km per hour for 1.85 km. Length of the tow is determined by Differential Global Positioning System (DGPS) and the vessel captain estimates corrections for tows that are not straight. Irregular bottom types occasionally cause haul length to differ from 1.85 km. Location, tow distance, depth, trawl time, and related information are recorded on the skipper trawl record form (Appendix A.1). Trawl placement within a station is determined by depth contours and the locations of trawlable substrate. All tows are made during daylight hours. Gear performance or changes in the stations towed are recorded in the skipper's comment section of the skipper trawl record form.

Deck Operations

Basic on-deck procedures and workflow are outlined below. Details on sorting/handling the catch, subsample, and data are included in subsequent sections.

Net Deployment

Skipper determines location within station for net deployment.

Engineer and Boat Officer

1. Reel out net and attach data logger to headrope.
2. Attach trawl doors to net and drop gear to depth.

Skipper tows net for 1 nautical mile (1.85 km).

Deck Preparation

During net deployment, towing, and initial retrieval

Cruise leader and technicians

1. Remove checker bin boards from port side.
2. Close aluminum door between checker bin and release chute.
3. Secure splitting net to bin.
4. Insert aluminum bin boards around sorting table.
5. Prepare polycorder, and cod tags.

Net Retrieval

Skipper determines location for net retrieval.

Engineer and Boat Officer

1. Raise gear from bottom and secure trawl doors to boat.
2. Reel in net cables, remove data logger from headrope, secure it to net reel, and reel in net.
3. Lift codend onto back deck.

Weighing Catch

After codend is on board and skipper is available to operate crane.

1. *Technician* wraps hanging strap around neck of net and attaches to crane.
2. *Skipper* uses crane to pull codend from under net reel.
3. *Technician* retrieves crane scale, and *boat officer* assists in attaching it to net and crane.
4. *Skipper* lifts crane scale, and *technician* turns it on and zeros it.
5. *Skipper* lifts codend and moves it into checker while *cruise leader* records total weight.
6. *Technicians* replace bin boards that were removed during deck preparation
7. *Boat Officer* opens codend and catch is released into bin
8. *Cruise leader* records weight of empty codend and *boat crew* rewinds net onto net reel.

Initial Subsample Handling

After codend has been emptied into checker.

1. *Technicians* untie splitting net from bin boards and attach net to crane.
2. *Skipper* lifts splitting net and *technicians/cruise leader* help guide to sorting table.
3. *Technician* moves crane hook to line on bottom of splitting net so *skipper* can empty net.
4. *Skipper* returns splitting net to checker, and *technician* removes it from crane.

Catch Sorting

When subsample has been put on table.

1. *Boat crew and technician* sort whole haul species (Table 1) from checker and place in baskets by sorting table to be weighed.
2. *Technician* tags Pacific cod.
3. *Cruise leader and technician* sort animals from sorting table and place in baskets.
4. *Cruise leader* weighs baskets of fish and other animals from table and checker.
5. *Cruise leader* records all weights appropriately on on-deck form.
6. *Technician* measures fish with polycorder while *Technician/boat crew* assists.
7. *Cruise leader and technicians/boat crew* measure crab.
8. *Technician* finishes sort of table and records all weights appropriately.

Between Hauls

1. *Staff* rinses sorting table and white totes.
2. *Technician or Cruise leader* downloads polycorder.
3. *Cruise leader* makes sure crab data is downloaded.
4. *Cruise leader* enters catch into database as time allows.

Temperature and Depth Data Logger

Depths and bottom temperatures are recorded by an XR-420-TD data logger during each haul. Before net deployment the logger is attached to the headrope of the net. When deployed it records the water temperature and depth, approximately 2 meters above the bottom. Tows average 25 minutes and data is recorded in one-minute intervals.

Once a week, data is downloaded to the dryhold computer. The data logger software (RBR5W03.exe) that is installed on the dryhold computer is opened before plugging the data logger into the computer or the logger will not register. For each set of hauls recorded by the data logger a graph of temperature, pressure, and depth is displayed. Save the downloaded data to the hard drive before setting the logger up for the next set of hauls. The files are saved using a name that is easily referenced, such as the download date, in numerical form (example 063005). Saved files are accessed later to determine the representative temperature that corresponds to each haul. An average is used if the temperature changes up and down are regular. If bottom temperatures fluctuate widely or the temperature changes are irregular, determine the

temperature that is most often recorded during the haul. When in doubt record the range of temperatures recorded and your best estimate on the corresponding skipper trawl record form.

To set the data logger for the next set of hauls synchronize the logger clock to the dryhold computer clock and ensure that presets such as sampling period and start and stop dates are updated. For detailed instruction on use and maintenance of the logger read through the RBR Ltd. Submersible Data Logger User's Manual (2003).

Catch Sampling

Determining Catch Weight

Catch weight from each haul is determined by weighing the codend of the trawl with an electronic crane scale accurate to $\pm$2.0 kg. After recording the total weight of the net and contents, the catch is emptied into the sorting bins. The weight of the empty codend is recorded and the weight of the catch is calculated by subtracting the weight of the empty codend from the total weight of the catch. The weight is recorded on the on-deck sampling form (Appendix A.2).

Crane Scale Troubleshooting. If the scale is not working properly the following steps should be taken.

1. If at any time the scale display reads "LO" it is an indication that the battery needs to be changed. A spare, charged battery is kept in the dryhold at all times.
2. At times the scale will need to be re-zeroed by lowering the codend completely to the deck to take the load off of the scale.
3. If neither 1 nor 2 get the scale working properly open the battery compartment door and check the connections between the scale and battery. It is possible that the connection has become loose, or that there is some corrosion. Clean out the compartment and make sure the battery is secure before trying the scale again.
4. If all of these fail to get the scale working properly the next recourse is to switch crane scales. There is always at least one extra scale kept on the boat during the survey.
5. If the neither scale will display a weight then the cruise leader must estimate the weight in consultation with the skipper.

Codend Too Large to Weigh. If the weight of the catch is too heavy to be lifted by the crane or over scale capacity, or if inclement weather does not permit accurate weighing, the weight of the catch can be estimated by the cruise leader in consultation with the skipper. Volumetric catch estimation may also be used to estimate the weight of the catch (AFSC 2003).

Additional Sampling Considerations

Total Catch Very Large. If the catch volume is large enough an extra splitting board may need to be inserted into the checker bin. The extra board keeps the amount of catch picked up by the splitting net manageable and prevents the fish in the checker bin from sliding back and forth in rough weather, allowing the crew to clear the area more safely and efficiently.

Total Catch Very Small. When the total catch is small (less than approximately 500 kg) it may be faster to sort the entire catch rather than subsample. In this scenario simply dump the entire contents of the codend onto the sorting table and weigh everything after it has been sorted. Before making the decision to sample using this method the cruise leader should consider the likely composition of the catch. For example, 400 kg of small fish <30mm could be quite time consuming to sort, so if this scenario is suspected the subsample method should be used.

Unrepresentative Split. The splitting net does not always pick up a representative sample therefore some of the catch from the checker bin may need to be shoveled into the subsample. The cruise leader will supervise this procedure to assure a representative sample is taken.

Mud Tows. Mud tows can be a problem for subsampling. The weight of the mud needs to be estimated if it makes up 10% or more of the subsample. Weigh the entire subsample with the mud in the splitting net. Rinse the mud and weigh the rest of the subsample to establish the proportion of mud in the total catch.

Large Debris/Shark Catches. Large pieces of debris (i.e., trees, tube worms, crab pots, etc.) and sharks may be caught in the trawl. These items should be whole-haul sampled and weighed separately from the rest of the catch. In cases where debris, such as a crab pot, is tangled in the net and does not make it to the codend the pot does not need to be weighed, but can be removed from the net and dumped back into the water after the netting has been cut. If the pot is filled with organisms they should be removed from the pot and included in the sample. If any of these large items have blocked or ripped the net, not allowing it to fish properly or preventing fish or crab from getting in, the station will have to be re-towed. The cruise leader will determine if a re-tow is necessary upon consultation with the skipper.

Whole-Haul Sampling

There are two major types of sampling that take place during each haul. For a select number of species (Table 1) every effort is taken to sample the entire haul for that species (whole-haul sampling). For all other species, samples are taken only from the splitting net (subsampling). Each species assemblage that is whole-haul sampled is counted, weighed to $\pm$0.1g, or where applicable, measured to $\pm$1.0 mm. The weights and lengths of whole-haul species are recorded on the on-deck sampling form. Finfish, sharks, and crabs are weighed, measured and numbers of individuals are recorded using the number of measurements taken. Octopus *Octopus dofleini*, giant wrymouth *Cryptocanthodes giganteus*, and box crab *Lopholithodes foraminatus* are counted and weighed only. Pacific halibut *Hippoglossiodes stenolepis* and skate *Raja* spp. and *Bathyraja* spp. lengths are recorded and weights are determined from length-weight conversion formulas. When a species is whole-haul sampled, a check mark should be entered in the *percent*

column of the on-deck sampling form. Weathervane scallops caught on the trawl wires are not included in the sample.

Shark and Finfish Measurements. Sharks are measured from snout to the fork or mid-point of the caudal fin. Skates are measured along the dorsal surface from the tip of the nose to the anterior notch of the pectoral fin (Appendix B). Pacific halibut and skate lengths measured without a polycorder need to be recorded on the deck form, then manually entered into the polycorder before downloading to the computer in the dry hold. When Pacific halibut or tagged Pacific cod measurements are recorded directly onto the polycorder, using the bar code strip and polycorder wand, note this on the on-deck sampling form.

Any deviations from the standard sampling procedures should be explained on the on-deck sampling form.

Crab Sampling

Handling Crab. All king, Tanner, and Dungeness crabs are to be separated by sex, weighed, measured, shell-aged, counted, and data recorded in the Microsoft Access crab database using the on-deck computer. Should the computer fail it will be necessary to manually record the data on the crab data form before the crabs are returned to the sea (Appendix A.3). Each data form should contain information from only one species and sex and every column completed when applicable.

All baskets of crab are weighed and sampled if possible. In hauls where Tanner crab are too numerous to be individually measured in a reasonable amount of time, a representative sample of 200 crab of each sex will be measured. Randomly sort all crab by sex into baskets. Since large crab tend to get picked up first, sample from the first baskets sorted as well as from the last baskets sorted. The crab not sampled should be sexed, weighed, and 'counted over' the side of the vessel. The number of countovers of each sex should be recorded in the C.O. column of the on-deck sampling form. This is still considered a whole-haul sample.

Large Amounts of Juvenile Crab. If there are too many juvenile Tanner crabs to measure and count completely in a reasonable time frame, then a subsample may be taken at the discretion of the cruise leader. Often one sex is more dominant than the other in the catch, so take a large subsample of crab to adequately sample both sexes. Every crab in the subsample will be sorted by sex and a total weight per sex will be collected. At least 200 crab of each sex will be measured. If the subsample still has too many crabs to measure within a reasonable amount of time count the remainder over the side of the vessel. Be sure to keep track of the sex of the measured baskets of crab. Indicate clearly on the front of the on-deck sampling form exactly how the crab catch was handled, as well as the number of crabs per sex counted over the side. The weight of the crab in the subsample will be extrapolated to the entire catch to estimate the total weight of crab in the catch. The percentage of males to females and the average weights from the subsample will be used to estimate the total number of male and female crab in the unsampled portion of the haul. Since this is only a rough estimate of the number of crab caught in the haul, use this method of sampling only when absolutely necessary.

King, Tanner, and Dungeness crabs shall be categorized by shell condition (Jadamec et al. 1999). Shell aging is very important so crabs should be examined under adequate lighting and free of slime and mud. Any questions regarding shell aging should be directed to the cruise leader. See Appendix C for details on shell aging categories.

Tanner crab carapace widths (CW) are measured inside the spines while king crab carapace lengths (CL) are measured from the right eye socket to the medial posterior edge of the carapace (Appendix D). Crab carapace width measurements are checked for legal status. Legal crab measurements outside the spines are 140 mm for Tanner crab, and 178 or 165 mm for red king crab from the Kodiak or Alaska Peninsula Areas respectively. These correspond approximately to biological measurements ranging from 136-139 mm CW for legal Tanner crab, and $\geq$140-157 mm CL for legal king crab. Measurements are recorded to the nearest millimeter using Vernier calipers. Fifty Tanner crabs with a CW greater than 50 mm will also be measured for chela height from each haul in Marmot Bay. Only the right chela of each crab is measured and crabs with regenerated claws are excluded. Measurements should be taken inside the spines at the point of greatest height (Appendix D).

Mature female Tanner and king crabs reproductive condition is determined by checking for the presence of an egg clutch and estimating the percent fullness of the egg clutch to the nearest 10%. Signs of bitter crab syndrome, black mat, nemertean worms, or cottage cheese disease (Appendix E) exhibited by crabs should also be noted during crab data entry. Dead eggs or matted egg cases are possible indicators for the presence of nemertean worms and crabs with those conditions should be inspected thoroughly. For additional details on determining clutch size and diseases see Jadamec et. al (1999).

On-Deck Crab Data Entry. Crab data are entered directly into an Access database using the waterproof deck-computer. Data will be entered separately according to species and sex. For ease of data entry, adult and juvenile females should be separated. It is the responsibility of the person entering the measurements to ensure completeness and accuracy of the data. After the crabs have been measured enter the number of countovers of each sex into the on-deck computer, as well as on the deck form.

After every haul, the deck computer data will be saved and downloaded to the dryhold computer. The new data must be added to the master Access crab database, and a copy of the measurements from the haul printed out. In the event that the deck computer fails, data will be recorded on an ADF&G crab form (Appendix A.3). Data will be edited daily to ensure that errors can be corrected.

Downloading Crab Data From the Deck Computer. Once all crab measurements and countovers have been entered into the deck computer, on the keyboard touch ‘download’. This will transfer the crab data to the dryhold computer. A prompt screen should appear on the deck computer confirming the download of the data into temporary files. It there are known errors in the data to be corrected, such as an incorrect haul number, they should be edited in the temporary files on the dryhold computer. If the data is correct to the best of the cruise leader’s knowledge open the crab database on the dryhold computer. Select the ‘append deck data’ button on the entry screen. When complete, **print a paper copy of the haul data.** This must be done after

every haul. Be sure the deck computer form is cleared of the previous haul data and set up for the next haul. This will prevent duplicate data in the database. At the end of the day the crab data tables should be backed up onto a third computer on the network, a CD-R, or a zip disk.

Pacific Cod and Walleye Pollock Sampling

Every effort should be made to whole-haul sample Pacific cod and walleye pollock. There are three types of situations that may apply when sampling these fish.

1) Low to moderate quantity of Pacific cod or walleye pollock: Whole-haul sample the Pacific cod or walleye pollock. Weigh all of the fish caught and measure at least 50 of each species. Additional measurements should be collected if fish size is variable.
2) Moderate to high quantity of Pacific cod or walleye pollock: Occasionally abundance will be too high to permit weighing of all fish and due to time constraints a modified whole-haul sample is required. Fill 4-5 baskets each of Pacific cod and walleye pollock for weighing and ensure that there are at least 50 fish of each species available to measure. Make sure you record the weights in the correct *measured* or *non-measured* column of the on-deck form. The fish remaining in the sorting bin can be counted over the side of the vessel and recorded in the C.O. column. This is considered a modified whole-haul sample. To determine the weight of Pacific cod or walleye pollock counted over, the cruise leader will calculate the average weight of the measured Pacific cod or walleye pollock and expand to the number counted over. This number gets recorded in the *non-measured* column. Record 100% in the percent column of the on-deck sampling form.
3) High quantity of Pacific cod or Walleye pollock: When walleye pollock or Pacific cod are too abundant to count over due to time constraints, and there are enough in the subsample for measuring, then subsample them from the splitting net. Do not attempt to estimate the total number and weight of the haul, the access database will provide the estimates. This is not a whole-haul sample.

Juvenile Pacific cod and walleye pollock may be sampled separately from the adults if they are present in large amounts.

Weathervane Scallop Measurements

At least 20 scallops per haul will be measured for shell height. Scallop shell height is measured to the nearest millimeter, taking the straight-line distance from the umbo to the outer shell margin (Appendix B). Measure only the top valve, which is shorter and the radiating ribs narrower than the bottom valve. Do not measure broken or badly chipped shells. Diseased or recently dead scallops are retained and packaged for shipping to the pathology lab. Measurements are entered into an Access database using the on-deck computer. The numbers of scallops not measured are entered as countovers.

Handling the Subsample

Commercially important finfish that are subsampled consist mostly of flatfishes. All species should be returned to the sea as soon as possible. Miscellaneous fish and invertebrates will be speciated and counted whenever possible, although time constraints occasionally require grouping of some species (i.e., sponges, brachiopods, clams, sea pens, anemones, hermit crabs, sea urchins, worms, and polychaetes). Garbage, kelp, empty shells, regurgitated fish, etc. are lumped into the "debris" category and weighed. The cruise leader will ensure that as many species as possible are positively identified, especially the shrimp, sea stars, snails, sea cucumbers, and sculpins. Care should be taken to correctly speciate the sea cucumbers and not to identify them as "cukes" (Appendix F). See Appendix G for a current species list. Crewmembers should be familiar with all species on the list.

Sorting and Weighing. Sort the entire subsample by species by placing them into baskets or small plastic trays. Make sure that the Measurement Systems International (MSI) motion compensated electronic scale is set to the correct tare (MSI 1998). For the orange baskets use tare #1 (large), set to 1.6 kg, and for the white totes use tare #2 (small), set to 1.0 kg. Weigh each basket or tray on the scale and record the species and weight on the on-deck sampling form. Mud should be rinsed off prior to weighing. Everything on the sorting table will be sorted and weighed.

When there are multiple baskets of the same species of fish, then a representative subsample of that species will be measured, but all baskets will be weighed to the nearest 0.1 g. Baskets of subsampled fish that are weighed, but not measured, are recorded in the *subsample weights, non-measured* column on the on-deck sampling form. The baskets of fish weighed and measured are recorded in the *subsample weights, measured* column. Record the number of individuals in the *Count* column. In the past, errors have been made because non-specific abbreviations of the species name have been recorded on the on-deck sampling form. When in doubt of an abbreviation that clearly identifies the species, write out the full common or scientific name of the species.

Fish Measurements. All commercial finfish species are measured from snout to the fork or mid-point of the caudal fin. When putting fish into baskets, there is a tendency to pick up the larger fish first, which results in the first baskets having a higher percentage of larger fish, while the later baskets have higher percentage of smaller fish. **It is imperative that the fish measured from the subsample are a representative sample of the catch.** To ensure a representative sample, either mix up the baskets or measure fish from the first and last sorted baskets. The sampling technique used will depend on the general size distribution observed in the sample. Consult the cruise leader before discarding fish.

The majority of measurements are recorded with a polycorder (Harrison 2003). A minimum of 50 fish of a uniform size sample is usually adequate; however, when the lengths in the sample are variable more fish should be measured. One hundred fish per sample with mixed sizes is not unreasonable. Remember, it's the number of fish not the number of baskets. To avoid scratching or damaging the polycorder stripes, lift rough-scaled fish (i.e. starry flounder) instead of sliding them across the board. Scratches will inhibit the wand from reading the bar codes on the stripes.

Sampling for Bitter Crab Syndrome (BCS)

Hemolymph smears from 30 randomly selected Tanner crabs will be prepared from each haul in Alitak Bay, totaling approximately 500 smears (Appendix H). This area was previously identified as an area of high prevalence of bitter crab syndrome (Pearson and Myers 1992). Each slide is referenced with the cruise number and then numbered in sequential order starting at number one (i.e., 0501-1). A separate crab form will be used to record all information with the sample number in the comment column. Data from these crabs will also be entered into the crab measurement database.

Rock Sole Identification

Northern and southern rock sole will be differentiated according to characteristics defined by NMFS (Orr and Matarese 2000). The blind side skin on southern rock sole is more transparent and the abdominal muscle pattern is clearly visible. Gill rakers of southern rock sole are more blunt and stout than those of northern rock sole. Southern rock sole have gill raker counts of 6-10 while northern rock sole are 10-14. Fish with 10 rakers are to be identified by blind side skin characteristics. Small fish (less than 20 cm) are difficult to identify and are to be entered as unidentified rock sole in the database.

Pacific Cod Tagging

A Pacific cod tagging program was initiated during the 1997 survey to study migration, growth patterns, and to identify inshore and offshore populations. The goal is to tag at least 5-10 Pacific cod per haul. Only Pacific cod that are in good condition (i.e., not bloated, distended, or with open wounds) will be selected. A fluorescent spaghetti tag is threaded into a tagging needle and inserted through the base of the dorsal fin, then the tag ends are fastened together. Use tags in sequential order and be careful not to tag too deeply into the musculature. Gentle handling and quick release of the Pacific cod are key to good survival. Size, tag number, and release location are recorded on the tagging release form prior to release (Appendix A.4). Tagged Pacific cod will be entered as species code 21722 into the database while untagged Pacific cod are assigned species code 21720. Weights of the tagged Pacific cod will be estimated from length-frequency tables.

If during the course of the survey a tagged cod is recaptured make note of the haul, tag number and fish length on the tagging release form, and return the fish to the water as soon as possible.

Walleye Pollock Otolith Sampling

Walleye pollock otoliths will be collected for NMFS. The goal is to obtain a random sample of age structures representative of the population available to the survey. The target number of

otoliths to be collected across the entire survey is approximately 600. Sample 20 walleye pollock for otoliths every other day throughout the entire survey. To ensure that fish of all sizes have the same chance of being selected, systematically set aside every n^{th} fish while taking length-frequencies with n being approximated by dividing the estimated number of fish in the length sample by 20. Rinse the otoliths with fresh water before placing them into vials filled with a solution of 50% ethanol and 50% fresh water to preserve the otoliths, making sure they are well covered. Record fish length and sex with each otolith sampled on the specimen form (Appendix A.5).

Database

Prior to initial data entry, vessel and cruise settings must be updated. On the Master form select 'Edit', then 'Update Vessel/Cruise' (e.g. 0501). Select done after corrections are made. See Harrison 2003 for further details on file maintenance and data entry.

After each haul, all data will be downloaded from polycorders and the on-deck computer and imported into the Microsoft Access database on the dryhold computer. Remember to record Pacific halibut, skate, shark, and tagged Pacific cod lengths into the polycorder before downloading.

Downloading the Polycorder

After all measuring is completed and the sorting table and checker bin are clear, the fish lengths recorded by the polycorder will need to be downloaded. Follow the steps below to properly download fish lengths.

1) Always start the dryhold computer first.
2) Start the polycorder transfer only when the instructions on the screen tell you to.
3) Connect the RS-232 cable to the polycorder and to the computer.
4) Select the Transfer Data menu and wait for the Transmit Type? prompt.
5) Transmit type is 0 (standard). Press 'Enter' on the polycorder. The data will scroll past on the polycorder.
6) The program will ask you if you want to download another polycorder (same haul only). When done select 'N' and the data will print out.
7) DO NOT delete the data from the polycorder until the data has been printed and checked. Make sure the counts for each species make sense and there are no abnormal lengths. If you find errors, select 'Edit', make corrections and then 'exit'.
8) After exiting, the length summary form will appear on the screen. Double-check all changes.
9) File the printout in the survey binder.
10) To clear the polycorder data so it is ready for the next haul, go to the polycorder menu and select the erase data option.
11) 'Shift Y' (on the 3 key) will answer the question "Sure?" There will be a series of beeps and the data will be erased permanently.

12) Go to “collect data” on the menu and type in the next consecutive haul number.

The polycorder’s batteries should be checked frequently. To test, insert the Battery Tester RS-232 port onto the polycorder, press ‘4’, check battery on main menu. The maximum voltage is 8.4 volts. Recharge the polycorder when voltage drops below 6.8 volts (Harrison 2003).

Entering Catch Data

After the polycorder has been downloaded open the Microsoft Access survey database. When the entry screen appears, select the ‘Enter Catch’ button and follow the steps below. For more specific instructions on entering catch data into the database see Harrison 2003.

1) Enter the haul number of the catch you will be entering. The catch entry form will open.
2) When prompted for a subsampling code, typically select option 2, subsampled. Occasionally the whole haul (100%) is sampled (code 1), or the catch may not have been sampled at all (catch not processed).
3) Enter ‘N’ for same proportion of all species. The only time ‘Y’ would be applicable is if the entire haul was sampled (100%), or if the entire haul was subsampled, meaning none of the species were whole-haul sampled.
4) Enter the total animal weight from the on-deck form. Microsoft Access will calculate the estimated weights of measured species from the length data.
5) To enter catch data from the on-deck form begin by selecting the down arrow within the species list combo box.
6) Enter the first few letters of a species and the list will become active.
7) Make sure the species name being entered is correct. If it says “do not use” enter a more specific identification.
8) Enter the measured weights in the appropriate column. This is usually the subsample column, even when a species is whole haul sampled.
9) If there is a fish species with a large number of individuals in the catch and it is not feasible to measure them all, enter the weights of the unmeasured portion into the non-subsample column.
10) To enter multiple basket weights click the ‘multiple baskets’ button. In this mode a window opens and multiple weights can be entered. Press’enter’ on a blank line to close the form.
11) Enter ‘N’ for species that are subsampled and ‘Y’ for species that are whole haul sampled. Remember that species counted over the side are still considered whole haul sampled.
12) The program automatically estimates weights for all fish lengths downloaded from the polycorder. Enter this computer calculated weight for halibut, skates, and tagged cod.
13) If there is a significant difference between the measured weight of a species and the estimated weight, the computer will prompt for a new entry. As long as no data entry/recording errors have occurred, using the measured weight is preferable.
14) To delete a species entry, highlight the species column and press ‘Escape’ (Esc).

15) After all the data has been entered, select ‘Quit’, ‘Print’, and ‘Save’.
16) Look over the printout to make sure that it makes sense before filing in the survey binder.
17) If there are errors, select ‘Edit’, and ‘Edit Catch’ from the main entry screen, and correct the items.
18) Check the circle on bottom of the on-deck sampling form when entry is complete.
19) Copy the database onto a CD-R every couple of days during the cruise. Run this backup process twice on duplicate sets of disks for safety.

Data Forms

It is the responsibility of the cruise leader to ensure that all the forms are completed and removed from the boat after each leg of the trip. The cruise leader should also copy the complete databases onto a zip disc or CD-R and take them back to the office immediately after each survey leg. Forms are to be organized according to species, sex, and put into sequential order by tow. Starting with the first tow and page on top. All data removed from the vessel is to be taken directly to the shellfish office and given to the lead trawl survey biologist or filed in the designated filing cabinet. This will prevent lost data.

QTC View Seabed Classification

The QTC View system maps habitat types in terms of substrate hardness by recording echo waveforms. Waveforms are classified into groups, which correspond to different bottom types. Ground-truthing with video and sediment grabs is a key part of acquiring valid data. The system will be deployed opportunistically on the vessel when it is available. Appendix I has more complete instructions on how to use the system.

Marine Mammal Observations

Marine mammal observations by crewmembers should be opportunistically recorded on a marine mammal sighting form (Appendix A.6). Detailed physical descriptions of the mammals and interactions observed with fishing gear, the vessel, or other marine mammals will be recorded.

SURVEY EQUIPMENT CHECKLIST

Net equipment
- ✓ Shackles, swivels, hammerlocks, rings
- ✓ Astoria trawl doors
- ✓ Dandylines and cables
- ✓ Nets: 3-5, 400 Eastern otter trawl
- ✓ Mending twine and needles

Weighing equipment
- ✓ Two crane scales
- ✓ Extra batteries for crane scale
- ✓ Battery charger for crane scale
- ✓ Large electronic platform scales (2)
- ✓ Backup platform scales (2)

On-deck equipment
- ✓ Knives: Victornox
- ✓ Bin boards
- ✓ Sampling table
- ✓ 2 fish shovels
- ✓ 35 fish baskets
- ✓ White plastic sorting containers
- ✓ Flexible measuring tapes (3-4)
- ✓ Calipers: at least 4 small and large
- ✓ Temperature and depth data logger: AA batteries, plastic holders (2)
- ✓ Digital camera and accessories

Bitter crab supplies
- ✓ White sampling tray
- ✓ Syringes: 3cc (20 g 1 ½) reorder # 309579
- ✓ 1,000 microslides, frosted on one end
- ✓ Slide boxes
- ✓ Plastic container for sharps disposal

P.cod tagging equipment
- ✓ Tagging board
- ✓ Spaghetti tags and needles
- ✓ Board for holding needles with tags

Polycorder equipment
- ✓ Polycorder wands, 10
- ✓ Board with code strip, and water connection
- ✓ Polycorders (4)
- ✓ 3-4 extra polycorder measuring strips, brass tacks
- ✓ Ziplocks for polycorder
- ✓ Recharging polycorder adapter

Computers
- ✓ Micron ‘dryhold’ computer
- ✓ Laversab ‘deck’ computer
- ✓ Rugged laptop as backup
- ✓ Disks: 3 ½ inch floppy, 3 zip disks, CDs
- ✓ Printer, power cable, connector to PC, spare ink cartridges
- ✓ Zip drive
- ✓ RS-232 connector (polycorder to PC)
- ✓ Power-pack battery backup (UPS)
- ✓ Waterproof crab keyboards (2)
- ✓ Cables, connectors for networking computers

Yearly survey information
- ✓ Project operational plan
- ✓ Survey charts with current station plans
- ✓ Printout of last year’s stations, date, starting and ending position, latitude/longitude, heading, crab counts

Dryhold supplies

- ✓ Scissors
- ✓ Hole punch, pencils
- ✓ Surge protectors
- ✓ Clip Boards
- ✓ Rubber bands
- ✓ Calculators
- ✓ Binders to hold data forms (10)
- ✓ 3-4 reams of paper

Reference materials

- ✓ NMFS ADP and species codebooks
- ✓ Alaska's Saltwater Fishes and Other Sea Life-D. Kessler
- ✓ Guide to Northeast Pacific Flatfishes-D. Kramer, et al.
- ✓ Fishes of Alaska-Mecklenberg, et al.
- ✓ Guide to Northeast Pacific Rockfishes-D. Kramer and V. O'Connell
- ✓ Pacific Fishes of Canada-J. L. Hart
- ✓ Data entry program and polycorder instruction manual-R. C. Harrison

Survey forms

- ✓ Form 1: Skipper trawl record form
- ✓ Form 2: On-deck sampling form
- ✓ Form 3: Crab measurement form
- ✓ Form 4: Pacific cod tagging form
- ✓ Form 5: Specimen form
- ✓ Form 6: Marine mammal sighting form

QTC equipment

- ✓ QTC View
- ✓ Power supply cable
- ✓ Computer serial cable to connect QTC and PC
- ✓ Transconducer cable to connect QTC to transducer
- ✓ Laptop
- ✓ HD disks and zip disks

Otolith sampling supplies

- ✓ 4 trays of vials
- ✓ Forceps
- ✓ Knives or hacksaw for sampling otoliths
- ✓ Ethanol
- ✓ Plastic dispensing bottles
- ✓ Stomach sampling equipment (NMFS)

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Table 1. Species that are whole-haul sampled.

Common Name	*Species Name*	*Counted*	*Weighed*	*Measured*
Alaska skate	*Bathyraja parmifera*			X
Aleutian skate	*Bathyraja aleutica*			X
Atka mackerel	*Pleurogrammus monopterygius*		X	X
Bering skate	*Bathyraja interrupta*			X
Big skate	*Raja binoculata*			X
Box crab	*Lopholithodes foraminatus*	X	X	
Dungeness crab	*Cancer magister*		X	X
Giant wrymouth	*Cryptocanthodes giganteus*	X	X	
Hair crab	*Erimacrus isenbeckii*	X	X	
Red king crab	*Paralithodes camtschatica*		X	X
Lingcod	*Ophiodon elongatus*		X	X
Longnose skate	*Raja rhina*			X
Octopus	*Octopus dofleini*	X	X	
Pacific cod	*Gadus macrocephalus*	X	X	50
Pacific halibut	*Hippoglossoides stenolepis*			X
Pacific herring	*Clupea harengus*		X	X
Pacific sleeper shark	*Somniosus pacificus*		X	X
Red sea cucumber	*Parastichopus californicus*	X	X	
Rockfish	*Sebastes* spp. and *Sebastolobus* spp.		X	X
Sablefish	*Anoplopoma fimbria*		X	X
Salmon	*Onchorhynchus* spp.		X	X
Salmon shark	*Lamna ditropis*		X	X
Spiny dogfish	*Squalus acanthias*		X	X
Snow crab	*Chionoecetes opilio*		X	X
Squid	*Berryteuthis magister*	X	X	
Tanner crab	*Chionoecetes bairdi*	X	X	200m, 200f
Walleye pollock	*Theragra chalcogramma*	X	X	50
Weathervane scallop	*Patinopecten caurinus*	X	X	20
Wolf-eel	*Anarrhichthys ocellatus*	X	X	

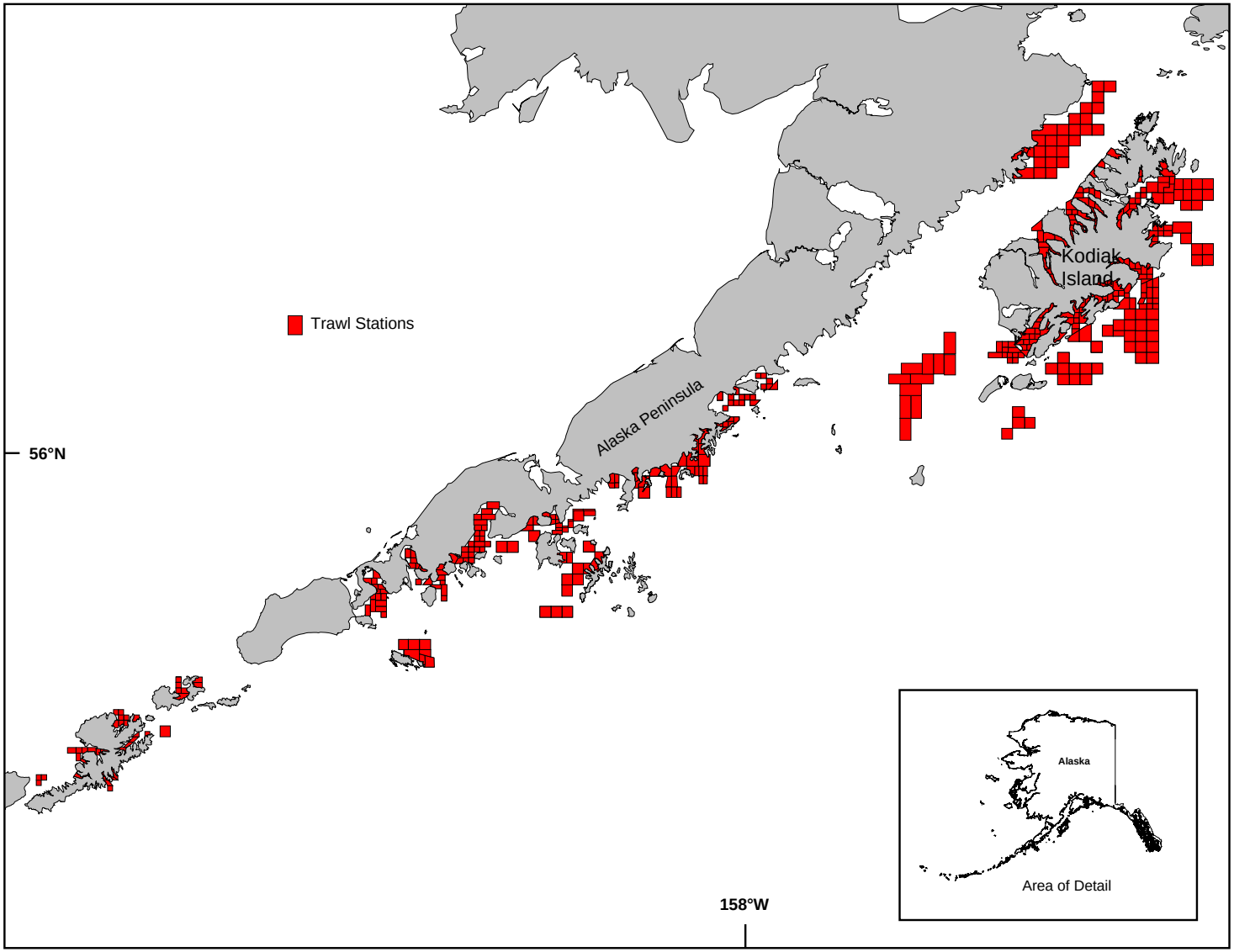


Figure 1. Westward Region trawl survey area.

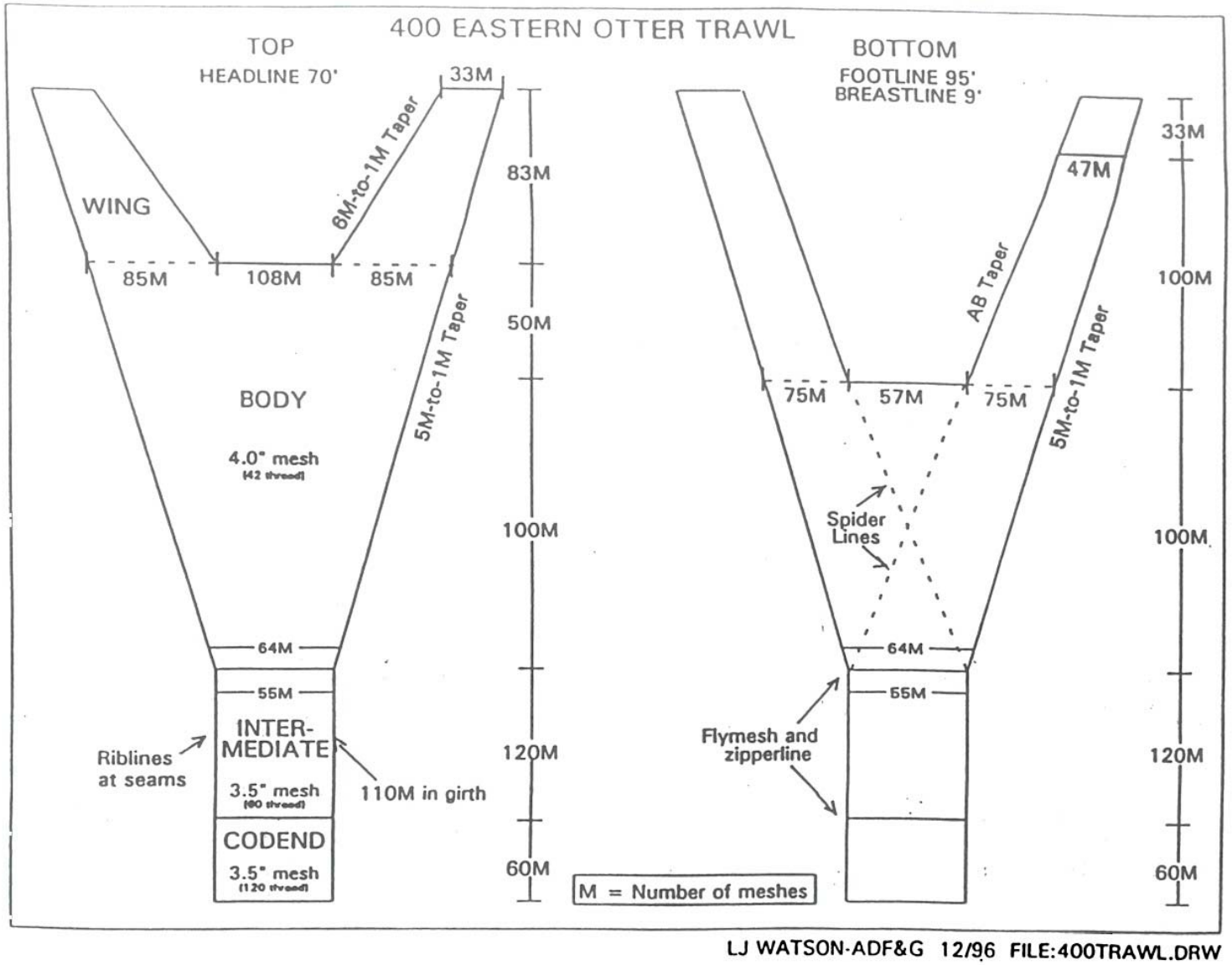


Figure 2. A 400 eastern otter trawl.

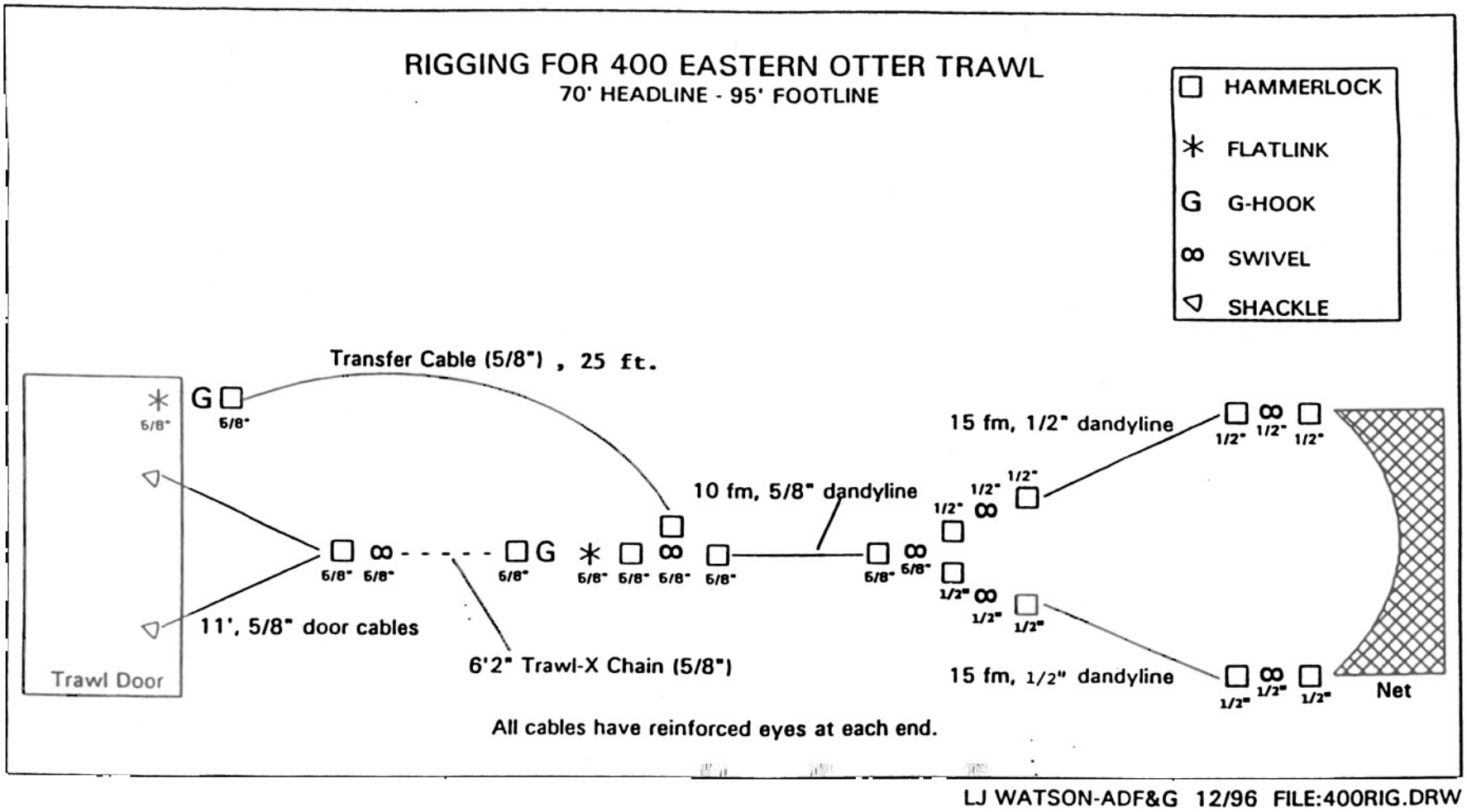


Figure 3. Rigging for a 400 eastern otter trawl.

APPENDICES

Appendix A.1. Skipper trawl record form and instructions.

ALASKA DEPARTMENT OF FISH AND GAME
2004 TRAWL SURVEY
SKIPPER TRAWL RECORD

Denis Cox Jr.
Skipper's Name

Survey Area

Cruise [1] Number	Haul Number	Net #	Survey Area	Stratum	Station Number	Vessel Code	Date month	Date day	Date year [23]
0 4 0 1	5	8	9	11	13	17	19	21	0 4

(1) Starting Position Latitude	(1) Starting Position Longitude	Compass Heading (magnetic)	Trawl Time Start	Trawl Time End	Dist-Towed
26	33	40 0	: 43	:	49
degrees/min	degrees/min				(nm)

(2) Haul Back Position		Elapsed
26	33	47
Position X	Position Y	(minutes)

Depth (fathoms) Maximum	Depth (fathoms) Minimum	Depth (fathoms) Avg.	Weather Cloud	Weather Sea	Weather Swell	Scope (fathoms)	Gear Perf.	Bottom Temperature
51	54		57	58	59	60	63	65

Skipper's Comments (gear problems, snags, weather, tides, etc.):

57. Cloud Cover	Code	58 Sea State (feet)	Code	59. Swell (feet)	Code
Clear	1	0 - 2	1	0 - 2	1
1/8 obscured	2	2 - 4	2	2 - 4	2
1/4 obscured	3	4 - 6	3	4 - 6	3
3/8 obscured	4	6 - 8	4	6 - 8	4
1/2 obscured	5	8 - 10	5	8 - 10	5
5/8 obscured	6	10 - 12	6	10 - 12	6
3/4 obscured	7	12 - 14	7	12 - 14	7
7/8 obscured	8	14 - 16	8	14 - 16	8
Completely overcast	9	Over 16	9	Over 16	9

63. Gear Performance	Code	Gear Performance	Code
Gear performance satisfactory	1	Mudded down	26
Gear performance unsatisfactory	20	Telemetry malfunction	50
Doors nonfunctional (crossed, collapsed)	21		
Net nonfunctional (collapsed, torn, twisted, etc.)	22		
Hung up	23		
Trawl upside down	24		

Initials: _____

Skipper Trawl Record Instructions

This form records each haul: area, date, position, time trawled, depth, length of tow, gear performance, and weather conditions.

Column Heading	Columns	Contents
Cruise Number	1-4	Sequential # by year, cruise (i.e. 0301).
Haul Number	5-7	Beginning with 1, each haul is numbered sequentially through each trip regardless of gear performance.
Haul Location	8-16	8- Net number . 9-10 Survey area (not used). 11-12 Strata (not used.). 13-16 Station Number (Consult charts).
Vessel Code	17-18	Resolution = 30.
Date	19-24	Month/day/year.
Starting Position/	28-39	Lat. Long., degrees/minutes (to .01)
Haul Back Position		
Compass heading	40-42	Heading towed.
Trawl time	43-48	43-46 Using 24 hour clock. 47-48 Elapsed time of tow (mins.).
Haul Depth	51-56	51-53 Minimum Depth (Fathoms 54-56 Maximum Depth (Fathoms).
Weather	57-59	57-Cloud, 58-Sea, 59-Swell (criteria on data sheet).
Scope	60-62	In fathoms (cable deployed).
Gear Performance	63-64	For each haul use performance codes on data sheet. Written description should accompany problem tows.
Bottom Temperature	65-67	Recorded upon download of temp. probe and entered on skipper form.

Appendix A.2. On-deck sampling form and instructions.

ON DECK SAMPLING FORM - SPECIES COMPOSITION

Total Wt.	
Bag (tare) Wt.	
Animal Wt.	

Vessel _____ Cruise _____ Haul _____

Date _____ Location _____

Recorder's Name _____

Species Name	c.o.	Whole-Haul weights	Subsample weights		Count	100%
			non-measured	measured		

Page____of____.

Check here after data has been entered: ◯

On-deck Sampling Form - Species Composition

Header Information:

Total Wt.	Total Weight of catch and trawl.
Bag (tare) Wt.	Weight of empty trawl net.
Animal Wt.	Subtract net weight from total weight.
Vessel	Vessel name conducting survey.
Cruise	Enter sequential year cruise number (i.e. 0301).
Haul	Sequential haul number for specified tow.
Date	Date (mm/dd/yy) of specified tow.
Location	Nearest bay or headland.
Recorder's Name	The name of the person/people recording data on the form.

Data fields:

Species name	List species name, either common or scientific, for each species sampled within the tow.
c.o.	Enter the number of individuals that were counted over the side of the boat, but were not weighed.
Whole-Haul weights	Species that are whole-haul sampled; enter weights in kg in this column.
Subsample Weights (non-measured)	Species from the subsample but lengths were not taken, enter weights in kg in this column.
Subsample Weights (measured)	Enter weight of animals in the subsample that were measured.
Count	Enter number of individuals from the subsample, or the whole-haul sample in this column. All animals, when possible, are to be enumerated if not measured on the polycorder.
100%	Check mark this column for all species that are whole-haul sampled. For species that are subsampled, no percentage is needed.

Mark the circle at the bottom of the form when data entry is complete.

Appendix A.3. ADF&G crab data form and instructions.

ADF&G CRAB DATA FORM

Page _____ of _____

SPECIES _____
SEX _____
VESSEL
DATE | | - | - | - | |

STATION NUMBER | | | | | |
POT ORDER | | |
BUOY NUMBER | | |
TRAWL HAUL NUMBER | | | |
SAMPLING FACTOR | | | | | |

COUNT-OVERS

	SPECIES	SEX CODE	CARAPACE LENGTH (MM)	CARAPACE WIDTH (MM)	SHELL CONDITION	DISEASE CODE		EGGS % CLUTCH FULLNESS	EGGS DEVELOPMENT	EGGS CLUTCH CONDITION	COMMENTS
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											
21											
22											
23											
24											
25											

CODE INSTRUCTIONS

SPECIES
1. L. AEQUISPINA
2. P. CAMTSCHATICA
3. P. PLATYPUS
6. C. BAIRDI
7. C. OPILIO
9. C. MAGISTER

SEX CODE
1. Sublegal Male
2. Legal Male
3. Juvenille Female
4. Adult Female

SHELL CONDITION
0. Soft
1. New
2. Old
3. Very Old

DISEASE CODE
1. Black Mat
2. Bitter Crab Syndrome
3. Nemertean Worms
4. Parasitic barnacle

EGG DEVELOPMENT
1. Uneyed eggs
2. Eyed eggs

CLUTCH CONDITION
1. Dead Eggs Not Apparent
2. Dead Eggs < 20%
3. Dead Eggs > 20%
4. Barren with Clean "Silky" Setae
5. Barren with "Matted" setae, empty Egg Cases

ADF&G Crab Data Form

Species and Sex	Common name or scientific name of crab listed in the first column of the form (only one species per form). Male or Female (only one per form).
Vessel	Name and/or number of vessel conducting survey.
Date	Month, day and year on which information is collected and recorded.
Station Number	Number assigned to specific location of trawl.
Pot order	For pot surveys only—not used on trawl survey.
Buoy Number	Number of buoy—pot surveys only, not used for trawl survey.
Trawl haul number	Numerical sequence of hauls.
Sampling Factor	Used to indicate the ratio of samples to entire catch. A '1/1' entry would indicate all crab caught were measured a '1/10' entry would indicate that one crab was measured for every ten crabs caught of the same species, sex, and shell age.
Countovers	Enter the number of crabs counted over the side of the vessel and not measured.
Species	Use codes listed on bottom of form, the numerical code must match the written species indicated at the top of the form.
Sex and Legal size	Codes are listed at bottom of form. The numerical code represents sex and legal size.
Carapace length	Indicate to nearest millimeter.
Carapace width	Indicate to nearest millimeter.
Shell condition	Codes are listed at the bottom of the form: 0, soft — Crab 0-2 months since molt. 1, new — Crab 3-12 months since molt. 2, old — Crab 13-24 months since molt. 3, very old — Crab 25 plus months since molt.
Disease code	Codes are listed at the bottom of the form. Potential diseases or parasites not listed should be noted in the comment section.
Eggs % clutch	The percent of egg fullness of the clutch, as estimated by measurer. Use increments of 10s.
Development	Codes are listed at the bottom of form for (2) eyed and (1) uneyed eggs.
Clutch condition	Codes are listed at the bottom of the form for (1) no dead eggs, (2) dead <20%, (3) dead >20%, (4) silky, (5) matted.
Comments	For notation of anything anomalous on individual crab such as parasites, morbidity, etc.

Appendix A.4. Pacific cod tagging form and instructions.

Pacific Cod Tagging Form

TAG NUMBER (C)	DATE	LENGTH	RELEASE LOCATION	ADDITIONAL COMMENTS
01				
02				
03				
04				
05				
06				
07				
08				
09				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				
29				
30				
31				
32				
33				
34				
35				
36				
37				
38				
39				
40				
41				
42				
43				
44				
45				
46				
47				
48				
49				
50				

Pacific Cod Tagging Form

Tag Number	Forms are pre-numbered with the last two digits that will appear on each tag. Fill in the first three digits from each tag used, making sure to keep tags in order.
Date	Date that fish was tagged and released.
Length	Fork length of fish being tagged and released.
Release location	List sequential haul number from haul where fish was released this information will be matched to the Skipper's logbook information at a later date.
Comments	Note anything anomalous about cod particularly if upon the release the fish looks as though it might be moribund.

Appendix A.5. Specimen form and instructions.

SPECIMEN FORM

PAGE ______ OF______

VESSEL [1 2 3] ____________________ CRUISE [5 6 7] HAUL [9 10 11]

STRATUM [13 14 15] SPECIES CODE [17 18 19 20 21] SPECIES NAME ____________________

FREQUENCY [36: 1] SUBSAMPLE TYPE [48] WEIGHT DETERMIN. [49] AGE STRUCTURE [50] AGE DETERMIN. [51]

MATURITY TABLE [59 60] YOUR NAME ____________________ DATE

23	25	28 29 30 31	37 38 39 40 41	45 46	53 54 55 56 57	62 63 64 65 66	68 69 70 71 72
SEX	MATUR	LENGTH IN MM.	WEIGHT (GRAMS)	AGE	SPECIMEN NUMBER		

Specimen Form

This form records the length, sex and corresponding otolith number for walleye pollock otolith sampling.

Vessel	1-3	Enter vessel, *Res* for Resolution
Cruise	5-7	Sequential number by year, cruise i.e. 001
Haul	9-11	Each haul is numbered sequentially.
Stratum	13-15	Leave blank
Species Code	17-21	Enter the 5 digit species code (i.e. walleye pollock, 21740).
Species Name		**Enter species name**
Frequency Subsample Type Weight Determination Age Structure Age Determination Maturity Table	**36-60**	**Leave blank, or to be filled in at a latter date.**
Your Name Date		Enter name of samplers and date.
Sex	23	Enter F or M for sex.
Maturity	25	Leave blank
Length	28-31	Measure length in cm and convert to mm.
Weight	37-41	Leave blank
Age	45-46	To be entered at a later date.
Specimen Number	53-57	Enter the sequential number from the label on the vial.

Appendix A.6. Marine mammal sighting form.

Form POP

MARINE MAMMAL SIGHTING

NOAA/NMFS/AFSC/NMML
Platforms of Opportunity
7600 Sand Point Way NE
Seattle, WA 98115

Observer(s)_____ Vessel_____

year | month | day | local time (24 hr. clock) | +/- GMT

latitude ° ' N/S | general location of vessel (optional)

longitude ° ' E/W | sighting conditions: xlnt good fair poor | Beaufort | +/- water temp. °C

species (common and/or scientific name) **Please fill out a form for each species** | confidence: sure likely unsure

sighting cue

closest approach (meters) | number sighted (best) | number (minimum) | number (maximum)

For Office Use Only

observer | platform | vis. | species | conf.

sighting cue | photos | roll | frames

behaviors, cues and interactions

behaviors, cues and interactions | length multi

Narrative

Make identifications only on specific features seen. Mention them here. Include body features, markings and coloration, associated organisms, elaborate on behaviors, etc. The most valuable sightings contain a good amount of detailed information.

Body Length Estimate

- ☐ < 3 m (< 10')
- ☐ 3–8 m (10–25')
- ☐ 8–16 m (25–50')
- ☐ 16–26 m (50–80')
- ☐ >26 m (>80')

Sketches

When possible, make a sketch noting pigmentation, anatomical features, scarring, posture, anatomical anomalies, group positioning, etc.

Some common behaviors
(circle these or add your own in narrative section)

Small cetaceans
Bow riding
Leaping entirely out of water
Porpoising (swimming fast, body out of the water)
Rooster-tailing (usually a Dall's porpoise cue)
Slow rolling

Large cetaceans
Blow visible from a distance
Breaching
Flipper slapping
Group feeding
Lob-tailing
Spy-hopping
Tail raised on dive
Side wake riding
Stern wake riding

Pinnipeds
Jug handle (flippers in air)
Porpoising (swimming fast, at least partially out of the water)
Rafting
Spooked from haulout
Vocalizing

Fishing Interactions
Contact with gear
Contact with vessel
Entangled in gear
Feeding on discards
Feeding from gear
Following vessel while fishing
Swimming near gear

Photos/Video (optional)
☐ photographs
☐ video

roll/tape # _____

frame(s) _____

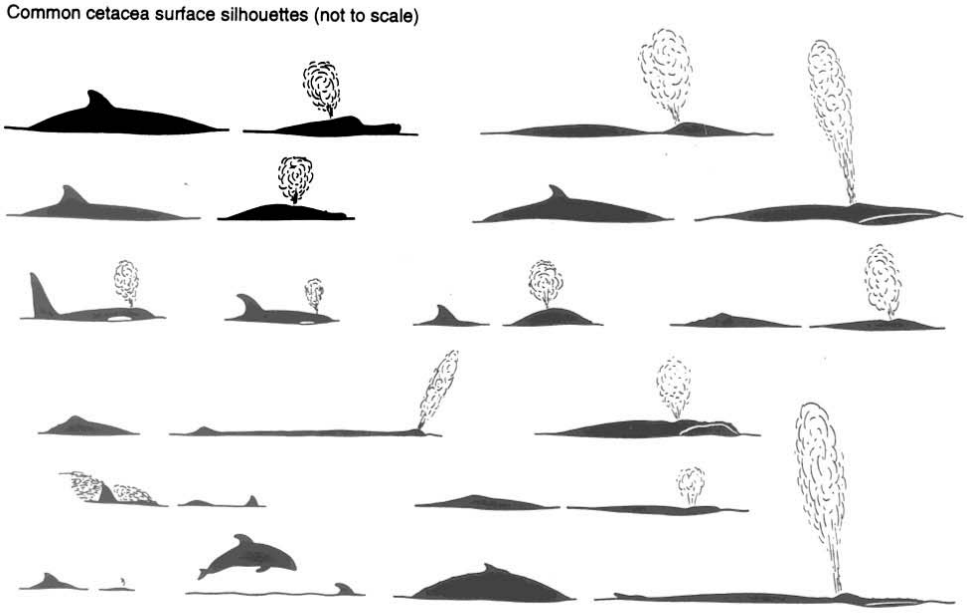
☐ **Check here if there was more than one species of marine mammal present at this sighting.**

Form POP: ver. XII.97: Balla, Harkness, Hill, Folkens, Lowell, Mizroch

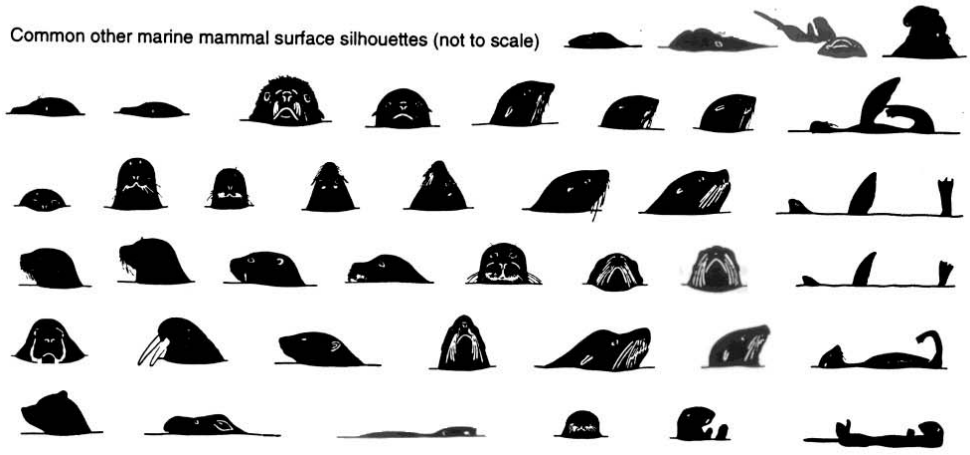
See silhouettes on other side

These are silhouettes of most genera of marine mammals known to occur in and around North America. Subtilties exist between closely related genera. Care should be taken in identifying species. Assessing one's level of confidence with copious notes and observations is more valuable than a brief misidentification. **Please circle appropriate silhouette(s).**

Common cetacea surface silhouettes (not to scale)

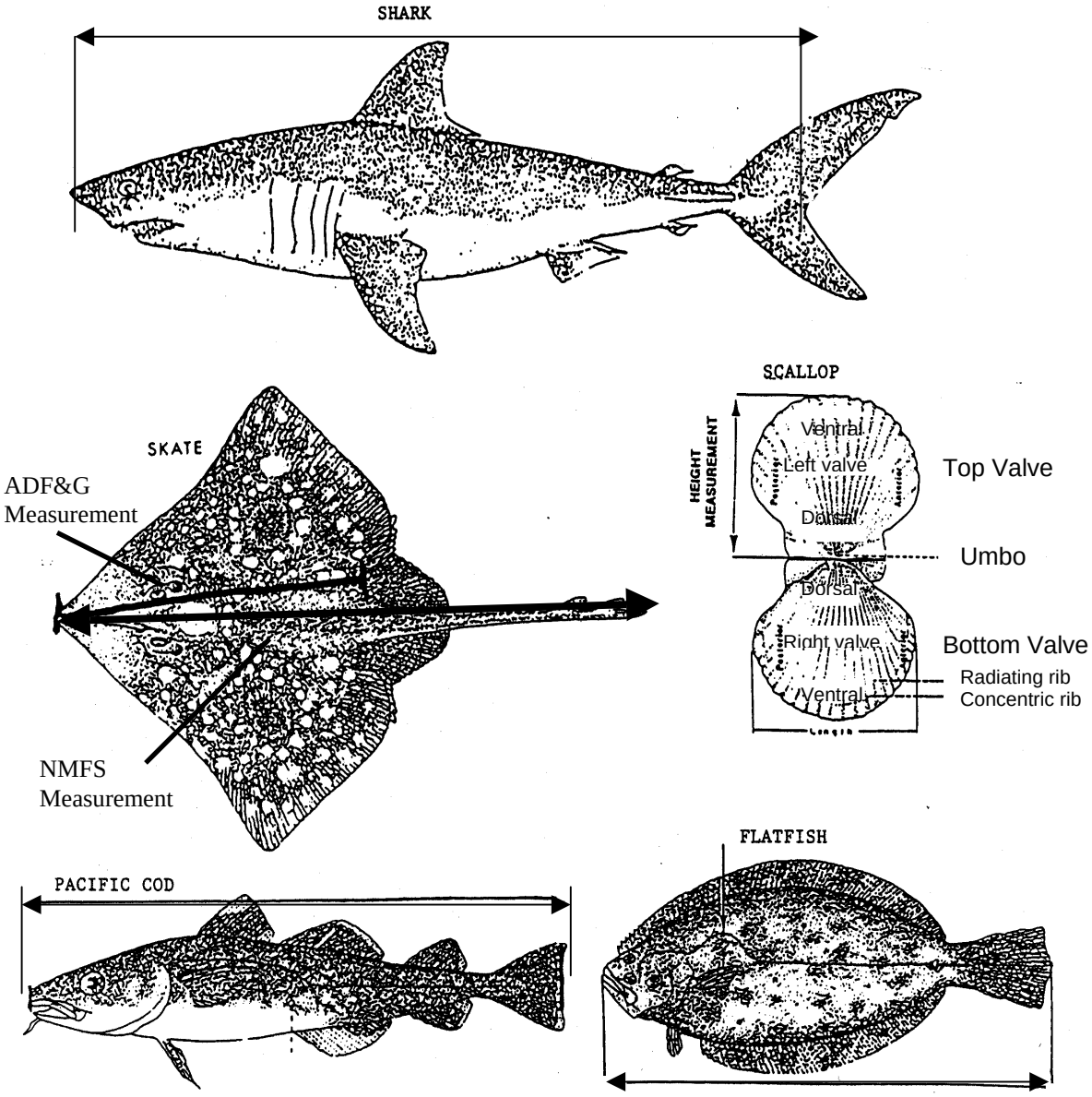


Common other marine mammal surface silhouettes (not to scale)



BEAUFORT SCALE (Sea Condition)		*wind*	*wave height*	
0	glassy, calm	0 , 1 kts	calm	
1	light ripple	1 < 4 kts	light air	1/4'
2	small wavelets	4 < 7 kts	light breeze	1/2'
3	scattered whitecaps	7 < 11 kts	gentle breeze	2'
4	small waves, frequent whitecaps	11 < 17 kts	moderate breeze	4'
5	moderate waves, many whitecap	17 < 22 kts	fresh breeze	6'
6	all whitecaps, some spray	22 < 28 kts	strong breeze	10'
7	breaking waves, spindrift	28 < 34 kts	near gale	14'
8	medium high waves, foamy streaks	34 < 41 kts	gale	18'
9	high waves, dense foamy streaks	41 < 48 kts	strong gale	22'
10-12	not meaningful (time to go home)			

Appendix B. Biological measurements for roundfish, flatfish, sharks, skates, and scallops.



Appendix C. Shell aging for Tanner, king, and Dungeness crab.

Shell age determination is made for all king, Tanner, and Dungeness crab sampled. Shell age should not be recorded for crabs not measured. Consistent and accurate shell aging techniques using shell appearance are difficult because there is some subjectivity involved. Time of year and substrate type, when known, is used in determining shell age as both can influence external crab characteristics.

Most commercially important species of crabs found in Alaska undergo an annual molt in spring through to summer. Crabs captured during legs of the survey conducted in late summer and early fall may demonstrate some old shell characteristics but in fact will have a 'shell of the year' and have not skip molted.

Additionally, crabs that inhabit a hard bottom will have the appearance of aging more rapidly than those that inhabit a soft bottom. It is important to bear in mind these factors when determining shell age.

Use the following characteristics in determining shell age.

Tanner crab: (*C. bairdi, C. opilio, C. tanneri, C. angulatus)*

(0) Soft Soft exoskeleton which is not fully calcified and flexible. Often chelas will remain slightly pliable and can be used to assess if crab have recently molted. Ventral surface devoid of scratches, carapace pink to brownish red in color. Exoskeleton spines very distinct and sharp if not pliable.

(1) New Shell Exoskeleton fully calcified and not pliable. Ventral surface with little scratching, carapace color pink to brownish-red, often with iridescence still present. Exoskeleton spines and dactyl spines sharp. Shells < 1 year old.

(2) Old Shell Ventral surface with numerous scratches and abrasions. Exoskeleton tan or light brown. Exoskeleton spines worn and dactyl points not sharp. Females will exhibit grasping marks on merus section of legs. Epifauna may be present but is not the sole characteristic that should be used to determine shell age. These crab have skipped a molt cycle and their shells are 2 years old.

(3) Very old shell Ventral surface with numerous scratches and abrasions. Exoskeleton dark brown to near black in color; spines heavily worn, dactyls dull, epifauna almost always present. Females will have multiple grasping marks on merus section of legs. These crabs will have skipped multiple years of molting and their shells will be 3+ years old.

-Continued-

King crab: (*P. camtschatica, P. platypus, L. aequespina)*

(0) Soft Soft exoskeleton not fully calcified and flexible. Chela often pliable if the rest of the body/legs are not. Color very bright, ventral surface bright white, dactys and body spines very sharp if not pliable.

(1) New Shell Ventral surface bright white, very few scratches or abrasions present, dactyl and body spines sharp, body colors bright. Shells < 1 year old.

(2) Old shell Ventral surface yellowish and stained, high degree of wear on coxa, dactyls dulled, body spines not overly sharp, body color dulled. These crabs will have skipped one molt cycle and their shells will be 2 years old.

(3) Very old Ventral surface light brown with multiple scratches and abrasions, coxa heavily worn, dactyls very dull, body spines dull, body color dark and often scratches and abrasions present on ventral surfaces. Epifauna often present. These crabs will have skipped multiple molt cycles and their shells will be 2+ years old.

Dungeness Crab:

Use same characteristics as king crab.

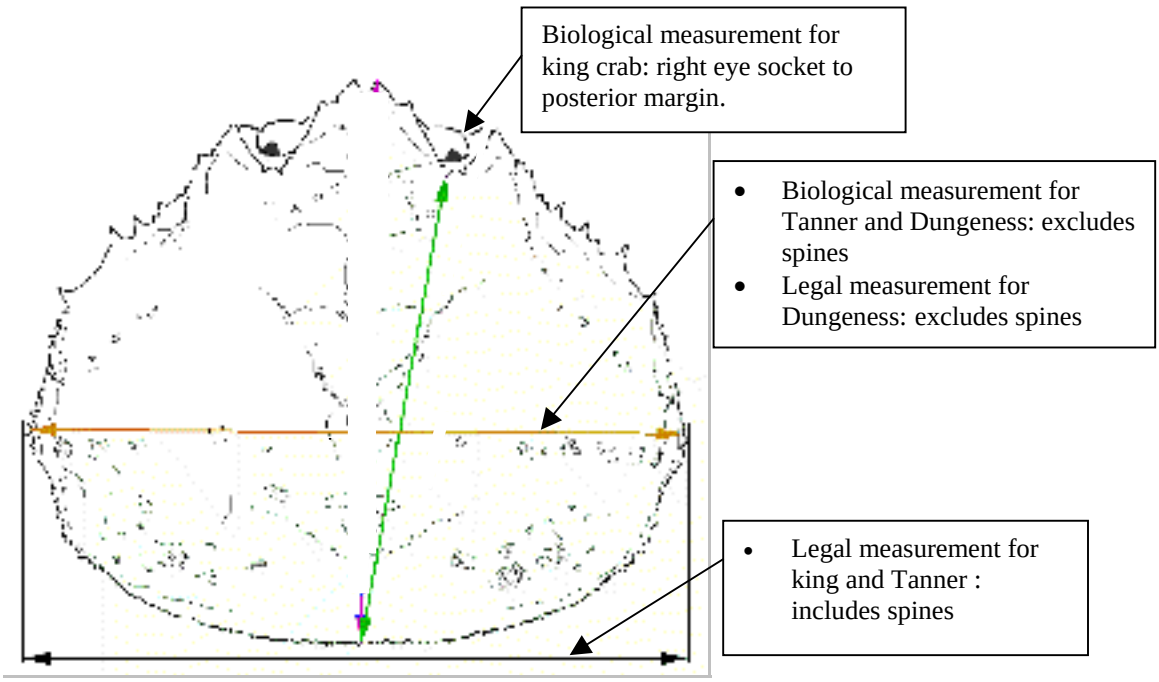
Appendix D. Crab measurements.

BIOLOGICAL CRAB MEASUREMENTS

All biological measurements are in millimeters unless otherwise noted.

All king crab species: The biological measurement for all king crab is carapace length. Using the vernier caliper, measure the straight line distance from the posterior margin of the right eye orbit of the carapace to the center of the posterior margin.

All Tanner species and Dungeness: The biological measurement for Tanner crab and Dungeness is the distance across carapace width **not** including spines. Measure the greatest straight-line distance across the carapace at a right angle to a line midway between the eyes to the posterior margin.



-Continued-

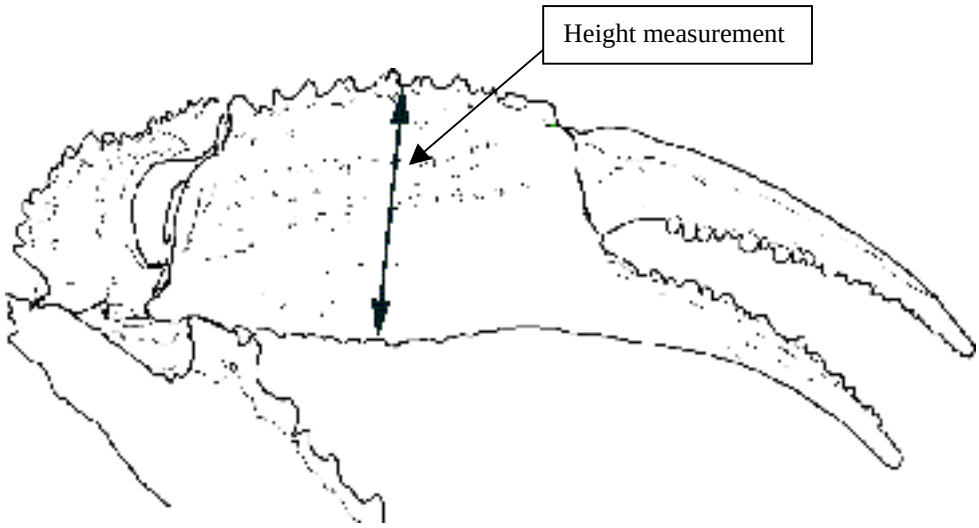
LEGAL CRAB MEASUREMENTS

All king and Tanner crab species: The legal measurement for king and Tanner crab is the straight-line distance across the carapace at a right angle to a line midway between the eyes to the midpoint of the posterior portion of the carapace. This **shall** include the spines on king and Tanner crabs. On king crab, the tergum, which is connected to the lower margin of the carapace by a visible suture, is not included in this measurement.

Dungeness crab: Dungeness are measured in a straight line distance across the carapace anterior to the tenth anterolateral spine (not including these spines). The legal measurement on Dungeness crabs is the same as the biological measurement.

CHELA HEIGHT MEASUREMENTS

Chela height measurements are the greatest height on the right chela, excluding spines. This measurement is the same for all crab species.



Appendix E. Crab diseases and parasites.

When present on or in a crab, the following are checked in the parasite column of the on-deck crab database, or listed in the comment section of the crab and fish measurement form. For photos of various diseases and parasites common on Tanner crabs see Jadamec et al. 1999.

Briarosaccus callosus

The rhizocephalan barnacle *B. callosus* has a worldwide distribution and parasitizes many crab species causing castration in the male and female crabs it infects. This parasite is found exclusively among king crab species. The externa of the parasite will be located in the abdominal flap of male and female crabs and will vary in size from as small as a jellybean to as large as a chicken egg. Coloration in the externa varies from pale yellow to pink to deep red. *B. callosus* is uncommon around Kodiak and along the Alaska Peninsula

Nemertean worms

These worms are found in clutches of adult female crabs. The nemertean worms prey on developing embryos and are most easily spotted in conjunction with clutches that have a high number of dead embryos. These worms can be found in the egg clutches of all commercially important crab species found in Alaska. They are small in size, red in color, and often 's' shaped during the early stages of development.

Bitter Crab Syndrome

Bitter crab 'disease' is caused by a dinoflagelate blood parasite. Live crabs in the latter stages of infection will have an exaggerated pink carapace or legs and milky blood observed if a leg is cracked. Crabs heavily infested with this syndrome are not marketable because of chalky flesh color and a bitter aftertaste.

Black Mat

Black Mat syndrome is a fungus that forms a thick, tar like mass on the carapace and appendages of Tanner crabs. It is distinguished from general epifaunal growth by its fibrous like texture when scraped.

'Cottage cheese' disease

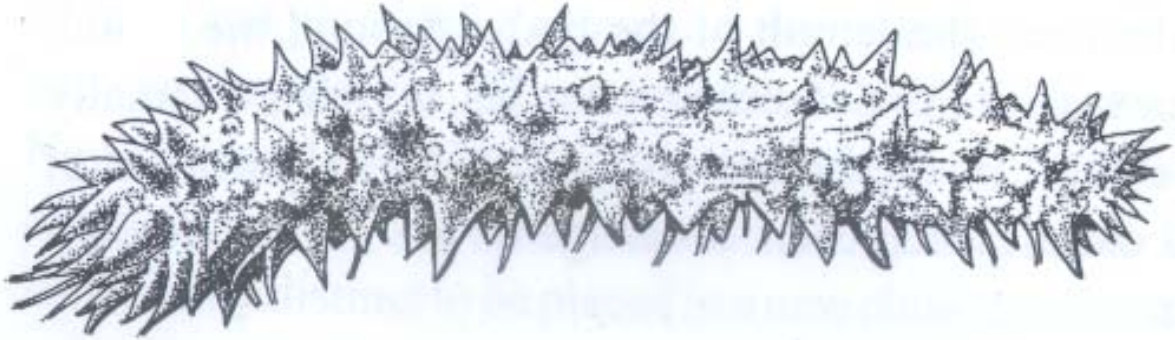
This microsporidian infection is recognizable by the white, large curd cottage cheese like appearance of the viscera. It is most obvious when the carapace is removed but can be visible in the tail sections of heavily infected crab that can be noted by their swollen abdomens.

-Continued-

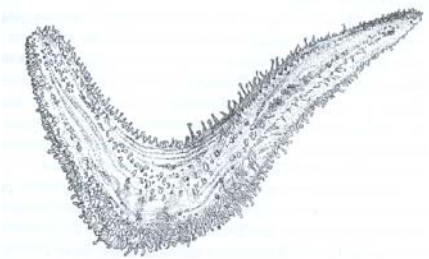
Chitinoclastic Bacteria or ‘torch’

This parasite is a bacterium that consumes the chitin in the shells of crabs. It occurs as dark spots or lesions that penetrate the host’s exoskeleton. The affected region will look as though a blowtorch has been used to burn the crab. Occurrence of this parasite should be abbreviated in the comment section as ‘CCB’.

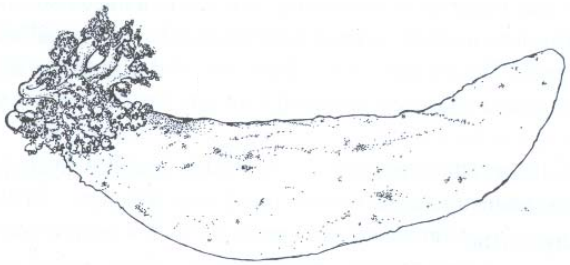
Appendix F. Common sea cucumbers.



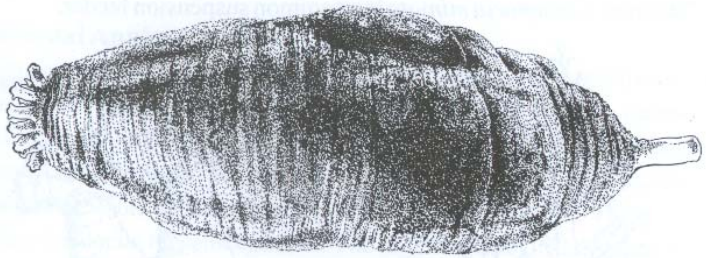
Parastichopus californicus



Pentamera lissoplaca



Cucumaria fallax
(Sea football, deflated)



Molpadia intermedia
(Sweet sea spud)

Appendix G. Species list

Species Name	Species Code	Species Name	Species Code
Alaska plaice	10285	Dungeness crab	68020
Alaska skate	471	dusky rockfish	30150
Aleutian skate	472	eelpout	24100
anemone	43000	egg case (snail)	71001
Aplidium sp.	98310	English sole	10170
argid shrimp (unidentified)	66570	eualus shrimp (unidentified)	66170
arrowtooth fld.	10110	eulachon	23010
Asterias amurensis	81742	flathead sole	10130
atka mackerel	21921	flatworm	92000
barnacle	65100	fragile urchin	82530
basket star	83010	*Fusitriton oregonensis*	72500
Bathyploides sp.	85180	giant wrymouth	23792
bay scallop	74104	great sculpin	21370
Bering skate	435	green urchin	82510
Berryteuthis magister	79210	greenland cockle	75285
big skate	420	greenland turbot	10115
bigmouth sculpin	21420	greenling (unidentified)	21900
bivalve shell	99993	hair crab	69400
bivalve shells	99993	hairy triton snail	72500
black rockfish	30330	halibut	10120
blackcod	20510	harlequin rockfish	30535
boccaccio rockfish	30400	helmet crab	68781
box crab	69270	hermit crab	69010
brachiopod	97000	hermit sponge	91016
brittlestar unid.	83000	herring	21110
bryozoan	95000	hippolytid shrimp (unidentified)	66150
Buccinum sp.	72740	humpy shrimp	66045
butter sole	10270	hyas crab	69578
cancer crab (unidentified)	68010	idiot rockfish	30020
Cancer oregonensis	68040	jellyfish	40500
capelin	23041	jingle	75605
Chlamys sp.	74104	juv. P.cod	21721
chum salmon	23235	juv. walleye pollock	21741
clams	74000	kelp crab	69530
cockles	74981	Kennicott's beringius	71770
Colus sp.	71710	king crab (red)	69322
coonstripe shrimp	66050	king salmon	23220
Crangon crangon	66502	left-hand welk	71755
crangonid shrimp	66500	light dusky rockfish	30152
Ctenodiscus crispatus (ninja star)	81780	lingcod	21910
Cucumaria fallax	85201	longnose skate	440
cuke unid.	85000	longsnout prickleback	23836
dark dusky rockfish	30151	*Molpadia sp.*	85115
Dasycottus setiger	21390	monster snailfish	22226
debris	99999	moonsnail (unidentified)	71525
decorator crab	68510	mussel	74050
dogfish	310	*Myocephalius sp.*	21375
dover sole	10180	*Myoxocephalus polyacanthocephalus*	21370

-Continued-

Species Name	Species Code	Species Name	Species Code
Neptunea sp.	71800	sea peach	98205
northern rock sole	10261	sea pen	42000
northern rockfish	30420	sea potato	98082
nudibranch (unidentified)	71010	searcher	20720
octopus	78403	sharpchin rockfish	30560
Pacific cod (P.cod)	21720	shortfin eelpout	24191
Pacific Ocean Perch	30060	shortraker rockfish	30576
Pacific Sandfish	21592	shortspine thorynhead	30020
Pacific staghorn sculpin	21380	shrimp (unidentified)	66000
pandalid shrimp	66019	sidestripe shrimp	66120
Pandalis borealis	66031	silky buccinum	72752
Pandalis goniurus	66045	skate	400
Pandalis hypsinotus	66050	skate egg case (unidentified)	401
Parastichopus californicus	85020	sleeper shark (Pacific)	320
Pentamera lissoplaca	85169	slender sole	10150
pink salmon	23230	smooth lumpsucker	22175
pink shrimp	66031	snail	71500
plain sculpin	21371	snail eggs	71001
poacher	20040	snailfish	22200
pollock (walleye)	21740	snake prickleback	23808
polychaete	50000	southern rock sole	10262
priblilof neptune	71820	spinyhead sculpin	21390
prickleback	23800	sponge	91000
prowfish	24001	spot shrimp	66040
Pycnopodia helianthoides	80160	squid	79000
red irish lord	21346	starfish	80000
red striped rockfish	30430	starry flounder	10220
red urchin	82520	Stearn's volute	72790
red-banded rockfish	30475	sturgeon poacher	20040
rex sole	10200	sweet sea spud	85115
ribbed neptune snail	71870	Tanner crab	68560
ribbed sculpin	21355	tomcod	21710
ribbed sinstral snail	71755	tube worm (unidentified)	50010
rock sole	10260	tunicate	98000
rougheye rockfish	30050	wattled eelpout	24185
roughspine sculpin	21366	weathervane scallop	74120
sablefish	20510	white-spotted greenling	21932
saffron cod	21735	whitebarred prickleback	23850
salmon shark	232	yellow Irish lord	21347
sand dollar	82730	yelloweye rockfish	30420
sand lance	20202	yellowfin sole	10210
sand sole	10250		
scallops (weathervane)	74120		
sculpin	21300		
sea mouse	50160		

Appendix H. Blood smears for bitter crab disease examination.

Sampling Equipment:

1. 1,000, 25 X 75, 1.2mm frosted slides.
2. 500, 1cc syringes with 20 gauge needles.
3. Diff-Quik stain set (3 solutions per set: a fixative solution, a second preservative, and a dye.
4. Hematology slide staining set (3 polypropylene containers in a metal rack and a slide holder for 25 slides) used for fixing and staining slides.
5. Distilled water.
6. Slide boxes (holds 100 slides).
7. Pencils to number slides.
8. Crab measurement forms to record details on each crab.

All items can be ordered from VWR scientific.

Slides should be labeled on the frosted edge of the slide with the sequential number, and year prior to sampling. The sequential number will be transcribed onto a crab measurement form in the comment column corresponding to the crab being sampled. All information on size, sex, shell condition, etc., will be written on the crab form. It is essential that slides used in making smear preparations are not scratched, non-corroded, and meticulously clean, free from grease, dust, acid, or alkali and that slides be handled by their edges.

From each location, randomly select 30 crab from each haul. Each crab will be numbered in sequential order for the cruise.

Bitter Crab sampling protocol - Ted Meyers, Fred Division, ADF&G 1990.

Method 1

This is a non-destructive procedure for sampling hemolymph using a 1 cc tuberculin syringe and a 22 gauge needle requiring a separate needle and syringe per crab specimen. Two drops (one drop may not be enough from the needle bore) of hemolymph are expressed from the syringe onto a glass slide previously labeled with appropriate data on the crab.

-Continued-

To collect the hemolymph, the needle should be inserted into the arthrodial membrane of the coxal joint of any leg. Also the elbow joint of the right or left cheliped is very good for obtaining hemolymph since these joints are usually presented in a bent position while the crab is in a defensive posture. The needle needs to be plunged about halfway to obtain the flow of blood. Be sure to wipe surface of the membrane clean with a paper towel so extraneous material does not contaminate the sample.

Each collector needs to experiment to get the hang of it first. Whichever leg is used, be consistent.

Method 2

In the absence of needles and syringes blood may be collected by pulling a rear walking leg and allowing 1-2 drops of hemolymph onto a glass slide. The drops will be large so be careful not to put too much on the slide. This is the less desirable technique since crabs may die later from the handling.

Making a Blood Smear

Do not make smears too thick or too thin and do not let any saltwater drip onto the slide as it causes artifacts in stain and cellular detail.

A drop or two of hemolymph is expressed onto a glass slide just below the frosted end and a clean slide is brought to the drop(s) until contacted and then moved to the end of the slide. Capillarity between the clean slide and the sample slide will spread the smear evenly along the length of the sample slide. Experimenting with the size of the drop of hemolymph and the acute angle of the clean slide will produce different smear thickness. It is suggested to discard the clean slide, but it may be reused as long as its used edge is thoroughly wiped clean of the previous sample.

Place the slide with the hemolymph smear in the slide holder used for staining. After spreading the hemolymph, hold the slide on edge to allow excess to accumulate and then blot that excess with a towel, before putting the slide in the holder. This helps prevent mold and bacteria from destroying the slide. Let the slides dry thoroughly before closing the holder and storing it.

-Continued-

Back in the lab. Fill each polypropylene container with one of the solutions. Each of the bottles is labeled with the contents. The slides are dipped first in the fixative five times. Second, the slides are dipped in solution 1 five times. The slides are then dipped five times in solution 2. Each dip should be followed by a short draining period such that the repeated dipping in the fixative and solution takes about a minute.

Following the final dip in solution 2, rinse the tray and slides with distilled water until the rinse water runs clear. Remove the slide from the tray and lay them out to dry, stained side up, in a horizontal position on paper towels away from dust. Slides should be stored in a slide box that prevents adjacent slides from contacting one another.

Used needles and slides should be collected and disposed of in an acceptable manner. Some hospitals will incinerate the materials. A commercial landfill may require a special fee for disposal of laboratory products.

Appendix I. QTC View operation.

Ensure that the following connections have been made. The serial cable is split, running from the serial port on the blue box to the serial port on the computer and the DGPS. The transducer cable is permanently installed in the wheel house and is wired into the transducer feed at the junction box to the echosounder and runs to the transducer port on the back of the blue box. The power cable connects to the transformer and 110 VAC power source. Always use protected UPS power for the system.

Currently the system is deployed in the calibration mode only as we assess the variability of bottom types found in the survey area. The system is rebooted every day. Every morning open the CAPS program from the icon on the desktop. The system parameters should be set and stable throughout the survey, with a base gain of 12 kHz and a minimum depth of 10 m shallower than the minimum depth to be encountered, although zero meters can be used.

Select Start from File>Calibration menu, naming the file for the date, (i.e., 16Jun03). Press Start to begin the calibration. Records should begin to accumulate, about one per second. Sometimes the signal is interrupted from the transducer because the bottom is too soft, and the system will stop accumulating records, so check periodically through the day to assure it is still running. There are three lights on the front of the blue box: 1) “Trig”, indicating transducer signal on, 2) “Clip”, indicating clipping of the signal meaning that the gain needs to be lowered if it lights more than occasionally, and 3) “Data”, indicating that data is being transmitted to the computer. Check either that the trig and data lights are flashing or that records are accumulating on the computer screen to assure the system is working.

Calibration creates two files, the .ffv and .cat. They grow at about 3 MB per hour. Always check the computer hard drive at the beginning of the day to make certain there is enough storage space. Save the data on a zip disk as required. Do not rename the files.
